ESTIMATING CROP LOSSES DUE TO HAIL

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ABSTRACT

Crops lost annually by hail damage have an estimated value of $403 million a year (at 1968 prices), or about 2 percent of the nation's total annual crop value. The same annual crop damage valued at 1973 prices would be $685 million. Over four-fifths of this damage is in wheat, corn, soybeans, cotton, tobacco, and grain sorghum.

The procedure developed for these estimates of crop damage due to hail used harvested crop values and crop-hail insurance loss payments per $100 of insured liability. Several downward biases in the estimates caused by data configurations are identified but not quantified.

Key Words: Crop losses, Crop insurance, Weather control, Risk, Production potentials, Estimates.

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PREFACE

The effects of weather and man's efforts to live with his environment have long been subjects of interest. In recent years, man has begun the attempt to influence weather in his favor, especially by developing techniques to cause local changes in selected weather patterns, such as hailstorms. In the process, many economic, legal, social, and political questions have been raised, which cannot be answered with existing information.

The Economic Research Service, U.S. Department of Agriculture, in cooperation with the National Science Foundation, is conducting a study to evaluate certain economic and institutional aspects of suppressing hail. The four objectives of the study are:

1. To improve existing knowledge of the extent of U.S. crop losses due to hail;
2. To analyze the prospective impact of large-scale hail suppression on cropping patterns in protected areas, and on the competitive position of the protected area relative to other areas;
3. To analyze the comparative effects of hail suppression and hail insurance on income flows and capital accumulation for different farming situations in high hail-risk areas; and
4. To analyze alternative institutional arrangements for organizing, financing, and operating hail suppression projects.

The following report presents some of the more interesting and useful results of the work on objective 1. As work on other objectives is completed, results will be made available in later publications.

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SUMMARY

A simple procedure was developed for estimating crop losses due to hail. Inputs are harvested crop values (as reported by the Cooperative State-Federal Crop Reporting Service) and crop-hail insurance loss payments per $100 of insured liability (provided by the Crop-Hail Insurance Actuarial Association). While the procedure has the advantage of using readily available data, the user must recognize several biases introduced by the data, which are identified but not quantified.

The use of paid losses on insured portions of crops, for example, does not take into account variations in the distribution of crop production, hail incidence, or insurance sales. In applying that loss rate to an estimate of crop value, one must also recognize that harvested value, probably the best available proxy, excludes not only hail loss, but losses from other causes as well.

The report considers these data shortcomings along with others, and concludes that the net effect of such biases on the loss estimates is downward. That is, estimates made with this procedure will tend to be understated rather than overstated.

In the United States annually, hail causes an estimated $403 million worth of damage to crops (valued at 1968 prices). The same physical damage valued at 1973 prices would be about $685 million. Over four-fifths of the total damage is accounted for by wheat, corn, soybeans, cotton, tobacco, and grain sorghums.

ESTIMATING CROP LOSSES DUE TO HAIL

Larry M. Boone[1]

INTRODUCTION

Evaluation of a loss-reducing technology must be based upon either measurements or accurate estimates of the relevant loss in the absence of that technology. Since there are no known measurements of total hail loss in the United States, investigation of the economic consequences of suppressing hail storms must rely on estimates of that loss.

Two attempts have been made in the past to estimate U.S. crop losses due to hail. The first attempt, by Lemons,[2] was in 1942, but is essentially useless today because of its age. The second attempt was in a 1969 report[3] to the Interdepartmental Committee on Atmospheric Sciences (ICAS), by the Economic Research Service (ERS), U.S. Department of Agriculture. It applied loss-cost ratios from private hail insurance companies to average annual crop values to estimate crop losses due to hail in the nine crop reporting regions of the continental United States. Estimates for a few selected smaller regions were made using the same methods. Those estimates suggested a potentially useful methodology for estimating such losses in more detail.

The subjectivity of Lemons' loss estimation was a result of basing the process on expansion of insurance payment of loss claims. He applied subjective factors to loss payment totals to estimate losses to insured and uninsured portions of the total crop, with little indication of concern for the rate of loss, or portion of the insured value which was damaged.

The 1969 ERS work attempted to avoid part of this subjectivity by using the rate of loss of the insured portion of the crop as the indicator of loss severity. This procedure retained some subjectivity, but represented an improvement. Both attempts to estimate national hail loss were restricted to estimates of losses suffered by crops because information concerning rate of loss is readily available in *crop* insurance records, but not in the records of insurance for other types of property. Records of the multiple-risk insurance usually written for buildings, equipment, automobiles, etc., generally summarize losses paid for hail damage. But identification of liability limits and premium costs which refer specifically to hail risk is quite difficult. It is very difficult, therefore, to establish the portion of *total* insured losses due to hail damage.

REGIONS AND UNIT SIZE

Hail suppression technology is still in its infancy. Information about the cost and technical problems of suppressing hail is scarce, and generally is not very specific as to storm characteristics and the size area for which hail suppression is technologically feasible. Therefore, it was desirable to estimate losses for the smallest geographic areas possible to permit the "construction" of loss estimates for areas.

The basic information needs for crop loss estimates appear to be deceptively simple. Records of crop production over a period of time must be available, along with records of hail losses. Fortunately, the Crop-Hail Insurance Actuarial Association (CHIAA) has calculated hail-loss rates for crops insured by their member companies. These data are available down to the township level, for important crops, over a 23-year period, for almost all States.

The usefulness of the CHIAA loss rates to our study grows out of the way claims adjustors fix the value of hail loss on insured crops. As soon as possible after the hailstorm, the adjustor makes a visual inspection to estimate the *percent* of physical damage suffered by the crop. Although this percentage estimate is converted into dollars by the insurance company, its identity is not lost. The settlement paid to the producer is equal to the estimated percent of physical damage times the total insured value, less deductible options. The ratio of losses paid to total insured liability is referred to as "loss cost" by the insurance company. Thus, the loss cost provided ERS by CHIAA is the dollar value of losses paid per $100 of insured liability. This understates the actual loss by the amount of deductible options included in the policies. (This understatement will be discussed more fully later.)

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[2] Lemons, H., "Hail in American Agriculture," *Economic Geography*, Vol. 28, pp. 363-378, 1942.

[3] U.S. Department of Agriculture, Economic Research Service, "Economic Aspects of Weather Modification," report to the Interdepartmental Committee on Atmospheric Sciences, May 1969.

Unfortunately, annual crop production data for small areas covering an extended period are not available. The Cooperative State-Federal Crop Reporting Service (CSFCRS) annual crop production survey provides good data at the State level. However, the reduction in data volume when county data are sought is remarkable. It was readily apparent that making estimates of crop loss at the township level was not feasible since too few observations are available to be considered statistically reliable. The only source of recent township crop production data was the 1964 Census of Agriculture. Combining 20 years of loss history and a 1-year sample estimate of production would produce disappointing and distorted results.

Thus, the smallest possible estimation unit appeared to be the county. CSFCRS reports county production data annually for the major crops. Since these annual reports are checked repeatedly and revised with Census data every 5 years, reporting errors can be caught and corrected, and the overall accuracy of the series improved. A 5-year average of crop production, 1966-70, was used to reduce the probability of estimating crop losses on the basis of an abnormal crop year.

It would have been prohibitively expensive to make detailed loss estimates for every State and county in the United States. So 10 States where crop loss due to hail was known to be of considerable magnitude were selected to represent cropping patterns and loss histories in important loss areas.

Two important indicators of the importance of crop loss due to hail are the percentage of crop value lost and the dollar volume of loss. In areas where 10 percent or more of crops are regularly lost to hail, the risk is of considerable importance, even if total crop value per acre is rather low compared to other areas. On the other hand, in areas where crop values per acre are high, even a loss rate of less than 1 percent can represent substantial loss in value.

Inspection of insurance loss records provided by CHIAA indicated that the Northern Plains States of Montana, Wyoming, Colorado, Kansas, Nebraska, North and South Dakota all suffer substantial loss of crop value because of hail. Crop production varies widely, making it difficult to choose one or two States as representatives of the region. These seven States were all included in the loss estimation sample.

Corn Belt States of Ohio, Indiana, Illinois, Iowa, and Missouri have a lower percentage of crop value loss than the above group, but the value of crop production per acre of cropland is higher. Since the major crops are essentially the same in all these States, Indiana and Illinois were selected to represent the region.

Tobacco is quite susceptible to hail damage at certain times of the year. Sixteen States experience some hail loss of tobacco, with the largest loss in North Carolina. North Carolina was included primarily as representative of tobacco loss patterns, although losses of other important crops in the State were considered.

ESTIMATING PROCEDURES AND LIMITATIONS

Superficially, the basic estimating procedure appears quite simple. One should simply multiply the average annual value of production of each crop in each county by the relevant loss cost. This should produce an estimate of the annual value of loss for those counties and crops.

There are several complicating limitations in the data, however, that affect the accuracy of such estimates. Some of these limitations concern how production data and the loss cost relate, others concern representativeness of the insurance data, and still others, the adequacy and availability of data.

The priority in devising the estimating procedures, given the large number of counties in the study, was to obtain the maximum information from the smallest number of variables.

The basic procedure developed requires only two items of information to begin the estimation process for a given crop or group of crops in a county:

1. A 5-year average harvested value, as reported by CSFCRS.
2. Loss cost for that crop in that county, as obtained from CHIAA.

The loss cost, as indicated earlier, is the average of losses paid per $100 of insured value of a given crop in a given county over the 23-year insurance history. A third item of information, an estimate of potential crop value prior to hail damage, is calculated during the process of estimating loss. The basic procedure is illustrated in figure 1.

Or in algebraic form:

$$L = \left[\frac{H}{\frac{100-R}{100}} \right] - H$$

Where:

L = Estimated loss,
H = Harvested crop value, and
R = Insurance loss payments per $100 of insured liability (loss cost)

The bracketed functions represent steps 1 and 2 combined. In other words, the brackets enclose the estimation of the original potential crop value, OPV, from which harvested value is subtracted to estimate loss (step 3).[4] *(Footnote 4 appears on next page.)*

1. 100% - Loss cost % = Estimated portion of original potential crop value represented by harvested value, or harvest percentage.
2. Harvested value $\div \frac{\text{Harvest percent}}{100}$ = Estimated original potential value of the crop before hail loss (OPV).
3. OPV - Harvest value = Estimated value lost to hail.

Figure 1.

Limitation of Crop Value Data

The available figure posing as our measure of crop production value of a given crop in a given county is the CSFCRS estimate of harvested value of that crop. By definition, this value excludes anything lost in a hailstorm, as *well as any production loss from other causes.* Therefore, the loss cost refers to a percentage of loss from some *unknown* value which was never realized by the producer, referred to above as OPV.

An accurate estimate of the value lost depends, in part, upon an accurate recreation of that mythical OPV, which in turn depends on whether or not other losses occurred before or after the hail loss. Insurance records summarize the value of some other losses, but the timing of those losses can be determined only by careful, detailed matching of weather records with insurance records. Some kinds of loss (e.g. drought), may occur gradually over a long period, may not lead to insurance claims, and cannot be pinpointed in time relative to hail occurrence. One must also remember that an insurance adjustor estimates physical damage from an apparent physical condition of the crop before hail. He makes no estimate of an OPV.

Case 1 below illustrates the difficulty of making estimates if there were other losses *after hail loss.* Case 2 refers to a case where hail loss occurred last. For illustrative purposes, let us assume that we have perfect knowledge of the values and timing of losses in the two cases, but that the claims adjustor and the loss estimator do not.

Case 1: Hail Loss Occurred Before Other Loss

What actually occurred:

June 12, Original potential value . . . $1,000
June 21, Hail loss 200
(Claims adjustor indicated 20 percent loss)
June 15-July 10, Drought loss 100
July 10, Harvest value 700

The OPV of interest is the actual OPV at time of hail loss, or $1,000. Keeping in mind the information we have, we proceed to estimate both the OPV, and the loss.

Estimating process using information available:

Harvested crop value (H) = $700
Loss cost (R) = 20 percent

$$\left[\frac{700}{\frac{100-20}{100}}\right] - 700 = \frac{700}{.8} - 700 = 875 - 700 = \$175$$

Following the basic procedures as above, we understate estimated loss.

Case 2: Hail Loss Occurred After Other Loss

What actually occurred:

June 12, Original potential value . . . $1,000
June 12-30, Drought loss 100
July 3, Original potential value 900
July 3, Hail loss 200
(Claims adjustor indicated 22 percent loss–(rounded)
July 10, Harvest value 700

Estimating process using information available:

Harvested crop value (H) = $700
Loss cost (R) = 22 percent

$$\left[\frac{700}{\frac{100-22}{100}}\right] - 700 = \frac{700}{.78} - 700 = 897 - 700 = \$197$$

In this case, the estimated loss is in error only by the amount introduced by rounding the loss estimate to 22 percent.

Calculating loss estimates from a "reconstituted original" or "before hail loss" value can eliminate only part of the understatement due to using estimated harvested values. The estimate still may understate loss, depending upon the timing of losses caused by factors other than hail. It should be pointed out that the foregoing also assumes accuracy of hail insurance adjusting. The adjustor establishes the rate of loss as a trained and experienced individual. His accuracy is enforced by the need for consistency with other adjustors who work in the same area. There is a threat of litigation if different adjustors do not recommend similar settlments on

[4] An alternate procedure for estimating crop loss due to hail is discussed in appendix A.

damages in similar situations for farms in the same neighborhood.

Distribution of Crop Production, Hail Losses, and Insurance Coverage

The other major limitation arises from questions of the representativeness of insurance loss data. Basically, we speak of multiplying an estimated harvested value of a crop by the historical rate of hail loss suffered by insured portions of that crop in that county. Calling the result an estimate of hail loss involves the rather disquieting implicit assumption that hail damage to *insured portions* of the crop is representative of hail damage to all of that crop in a county.

Perhaps the significance of this implicit assumption to estimates of hail loss can best be seen by considering the interaction of three variables within a county, as illustrated by four hypothetical counties shown in figure 2. The distribution of crop production (C) in a county depends largely upon factors such as topography and soils. The distribution of *hailfall* (H) is an autonomous factor of variable distribution. The distribution of hail insurance coverage (I) will also be independently distributed, so that estimated losses will be representative only of that part of a county's crop covered by hail insurance.

If all three were similarly distributed, as in county W, or if crop production and insurance are similarly distributed, as in county X, the rate of loss on insured portions of crops is probably a good estimator of total loss.

Counties Y and Z represent interesting problem cases. Historical point frequencies of hail occurrence do vary within counties, as reflected by differing hail insurance premiums from one township to another. However, on a year-to-year planning basis, there is no way of knowing what part of a county will receive damaging hail.

County Y represents a hypothetical county where farmers have accurately predicted where hail will occur, and have insured only in those areas. In this case, the application of loss rates of insured portions of crops to total crop values for the county would lead to overestimation of loss. This case is oversimplified, of course. Over time, it would be rare to find a county where hailfall could be predicted that accurately. The spread of insurance into the other crop areas would tend to improve the estimates by averaging the low or nonexistent losses into the loss rate used. Use of several years' data for both insurance loss rates and crop production help reduce the likelihood of this situation.

County Z depicts a situation which might occur for at least two reasons. Farmers may inaccurately predict the risk of hailfall and not insure in the western (left) part of the county. In this case, the loss rate from the insured portion may be an adequate estimator of the general loss occurrence. The more likely cause of the County Z situation, however, is that the historical loss rate is so severe that insurance premiums have become prohibitive. The loss rate of the insured portion of crops would then underestimate total loss in the county. Further, our use of long data series for insurance losses and crop production would do little to improve the estimates of loss.

There are a few other points relating to the use of insurance loss data to estimate total hail loss. The point most frequently raised is that even farmers who insure their crops do not insure for "full coverage" or for 100 percent of their value. While quite true, this fact introduces little bias into estimates made with the procedures discussed above. The loss paid still represents a percent physical damage times insured value, and it matters little whether the farmer insured for $20 or $100 per acre.

Two other points which relate to common characteristics of hail insurance policies, however, do have an important effect on loss estimates made using the described procedures. The first is a "minimum loss" clause often included in crop-hail policies, which states that no claims will be considered for losses below a specified percentage, usually 5 percent. It is practically impossible to estimate the downward bias in our estimates from hail damage which is not reflected in insurance records because of this clause. An entirely subjective evaluation by the author would be that such bias is probably not large. Patterns of hailfall make it unlikely that a given area would receive repeated damage at low levels, and most crops through most of their growing periods can recover from light hail damage fairly well.

The second point involves the common deductible provision, usually known as the "excess over" clause. These "excess over" policies exclude the first 10 or 20 percent of loss. They differ from the "minimum loss" policy as illustrated in the following example: two farmers suffer 25 percent physical damage from hail. The farmer with the "5 percent minimum loss" full coverage policy collects 25 percent of his insured value. The farmer with the "excess over 20 percent" policy collects 5 percent of his insured value.

The impact of the "excess over" policy on estimates is illustrated by the same example. If both farmers had insured their crop for $100 per acre, the loss cost would be 25 in the "minimum loss" case and 5 in the "excess over" case. Since "excess over" policies are most common in high hail risk areas because of high premiums, they could result in substantial downward bias in loss estimates. The estimates were made without adjustment for this bias. Further study would be required to estimate the extent of this bias.

Availability and Adequacy of County Data

Some of the data difficulties in selecting a unit level and sample area for developing an estimating procedure were discussed previously. Having selected the county as the basic estimation unit to work with, there were a few specific examples of those data difficulties which should

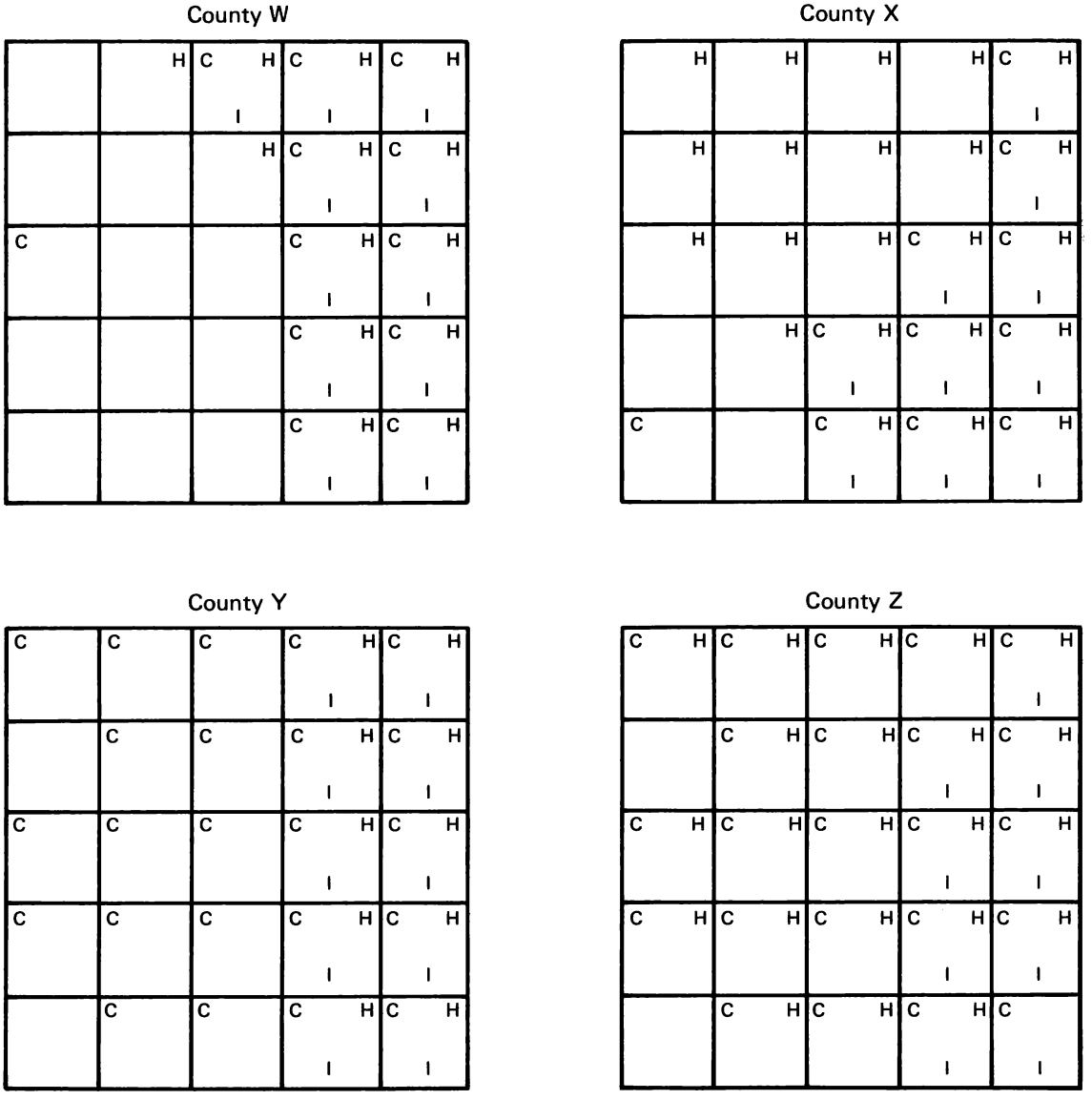

Figure 2.

be mentioned. Some examples of these difficulties are:

There were no insurance histories available from CHIAA for some counties in the 10-State sample. For a few other counties, limited insurance histories were available but the all-crop loss cost was zero, indicating no loss claims during the 1948-70 period.

In other cases, while a loss history existed, it was not considered an "adequate" history for making a reliable loss estimate, and these county-crop combinations were also eliminated. The rather arbitrary definition of an "adequate" loss history was based on total insured liability of that crop in that county over the 23-year insurance history compared to the average annual value of production of that crop in that county during the 1966-70 period. If farmers' perception of hail risk over the past 23 years led them to insure a value equal to at least 25 percent of the 1966-70 average production of that crop, the loss history was considered adequate for use in estimation. In some counties all crops which appeared to be of major importance were eliminated by this adequacy test. In general, it is assumed that hail risk in these counties is not great enough to concern us in making hail loss estimates. However, some crops of considerable importance might have been left out of the original crop list because data were not available at the county level. The likelihood of that happening seems fairly low, however, because data tend to be available for the more important crops.

One or more, but not all, crops were eliminated from many counties on the basis of the adequacy test. It

should be pointed out that when the insurance loss history of a crop failed to meet the adequacy test, the value of that crop was not included. Loss estimates were based only on the value of those crops for which loss histories were deemed "adequate," and *not* upon the total crop value in the county.

Because of the long insurance history, the elimination procedure discussed above might appear to include crops of declining importance and exclude crops of increasing importance. This tendency probably had little or no adverse effect on the estimates yielded. Crops which have declined to minor importance in a county already were excluded in the original data selection, because of the recent period used for determining average crop value. Excluding crops which are rapidly expanding in importance might reduce the magnitude of the loss estimate in some counties, but that must be weighed against the larger potential error of including estimates based on scant insurance history.

Those crops eliminated by the adequacy test may be of small importance to individual counties. However, many of them are susceptible to hail damage, and are produced in substantial amounts in many parts of the country. Therefore, it would appear advisable to limit the use of county data to those situations where the desire is for loss estimates covering a relatively small multicounty area. When regional or national estimates are desired, one must seek a data base which allows a more complete account of "minor" crops.

For those interested in county data compiled for this section, an 88-page supplement to this publication is on file at Land-Grant Libraries and the National Agricultural Library (NAL). This supplement contains estimates per county and per crop acre for the major crops in the 10-State area discussed; estimates of total losses of all "major" crops (those surviving the adequacy test) per county and per square mile of land area in the county; and a list of crops eliminated by the adequacy test, by State and county. Micro file or photo copies may also be purchased from the Lending Division, National Agricultural Library, U.S. Department of Agriculture, Beltsville, Maryland 20705. Write NAL for current prices on this service.

Some counties in the 10-State study area had some individual crop loss totals of $500 or less and some per-acre losses of less than $1.00 for individual crops.

Table 1 gives some idea of *maximum* annual crop losses per county and per acre. Table 1 helps establish the upper range of individual crop losses in each State. It is interesting, but not too suprising, to note that the highest per-acre losses seldom occur in the same crops as the highest county total losses in the same State.

There is no intention to imply that county crop loss estimates have no value. Within a given State they can provide valuable insight into the distribution of hail risk among the counties and major crops. The point is that if large-scale loss estimates are the desired product, the lack of adequate county level data for many crops provides an incomplete estimating base.

LOSS ESTIMATES FOR THE UNITED STATES

Since data inadequacies at the county level prevented the "construction" of State, regional, and national estimates by aggregation, a second stage of loss estimates was employed using essentially the same estimating procedures, and shifting the data base to the State level.

Most comments made earlier concerning the method of estimation still apply. The same divergence between harvested value and potential value and the same question of representativeness of insurance histories apply at the State level as at the county level. The question of representativeness of insurance history is more severe at the State level because of the greater likelihood that areas exist where crops are not insured. Application of loss rates for areas where hail occurred to values of crops produced where no hail occurred may result in some overestimation of loss. On the other hand, underestimation caused by crop loss due to other hazards, use of minimum loss clauses and deductible provisions in insurance policies, and the tendency for high premiums to reduce insurance coverage in the highest risk areas is also intensified.

Working from the State level in making national loss estimates afforded advantages in data availability. A particular advantage was the availability of production data for fruits, vegetables, and specialty crops. Investigation of State production data and insurance loss histories led to the selection of the list of crops appearing in Appendix B table 1 (pp. 11-39). These crops are major national products with loss histories. In some cases, a crop was included in spite of relatively minor national importance, because its production and loss were important in one or more States. In other cases, relatively important crops were excluded because hail loss was not large in their areas of major production. Extra crops were included for Washington, Oregon, and California because production of those crops in the Pacific Region, especially California, is a significant part of national production, and hail loss is substantial.

Regional and national loss estimates in tables 2, 3 and appendix B table 1 are direct aggregations of State estimates, not calculated estimates. Regional loss rates were not available, at least for the regional breakdown used. For the national estimates, summations were considered more accurate than those yielded by calculations using nationally averaged loss rates on a crop-by-crop basis.

To those familiar with U.S. crop and hail data, there are few surprises in appendix B table 1. Wheat, corn for grain, soybeans, cotton, tobacco, and grain sorghum are all major crops in the principal hail regions of the

Table 1—Representative maximum-loss estimates for one crop, per county and per acre, by States, 1966-70

State and county	Crop	Estimated maximum annual losses in county[1]	State and county	Crop	Estimated maximum annual losses[1] per acre
		Dollars			Dollars
Colorado			*Colorado*		
Washington	Wheat	861,000	Rio Grande	Potatoes	14.59
Logan	Wheat	779,000	Alamosa	Potatoes	14.54
Illinois			*Illinois*		
La Salle	Corn, grain	471,000	Lee	Soybeans	2.74
McLean	Soybeans	274,000	DeKalb	Soybeans	2.45
Indiana			*Indiana*		
Benton	Soybeans	124,000	Warren	Soybeans	1.85
White	Soybeans	115,000	Warren	Oats	1.72
Kansas			*Kansas*		
Sherman	Wheat	815,000	Saline	Soybeans	14.95
Reno	Wheat	553,000	Finney	Corn, grain	8.04
Montana			*Montana*		
Chouteau	Wheat	573,000	Dawson	Sugar beets	25.85
Valley	Wheat	511,000	Custer	Sugar beets	21.98
Nebraska			*Nebraska*		
Cheyenne	Wheat	948,000	Dawson	Sugar beets	37.80
Phelps	Corn, grain	942,000	Box Butte	Dry beans	35.38
North Carolina			*North Carolina*		
Wake	Tobacco	856,000	Wilkes	Tobacco	66.84
Pitt	Tobacco	756,000	Wake	Tobacco	54.01
North Dakota			*North Dakota*		
Hettinger	Wheat	892,000	Slope	Wheat	6.48
Divide	Wheat	692,000	Bowman	Wheat	6.06
South Dakota			*South Dakota*		
Turner	Corn, grain	462,000	Butte	Wheat	4.85
Union	Corn, grain	366,000	Lawrence	Wheat	4.72
Wyoming			*Wyoming*		
Goshen	Wheat	200,000	Sheridan	Sugar beets	17.90
Laramie	Wheat	198,000	Fremont	Dry beans	5.35

[1] Valued at 1968 prices.

country where they account for over four-fifths of the total national hail loss. While no individual tree fruits appear high on the list in the summary table, estimated combined losses surpassed $20 million, or over 5 percent of the total.

There are many examples in the table of the uneven distribution of loss among regions and States. Estimated regional loss totals range from a low of $2.7 million in the New England Region to a high of $183 million in the West North Central Region. Within each region, one can see the unequal distribution among States and commodities. In the New England Region, for example, nearly half the estimated loss is in tobacco. Nearly 80 percent of New England's tobacco loss is in Connecticut, where the loss rate was close to 4 percent. In the West South Central Region, over three-fourths of the loss occurs in cotton and wheat. Nearly 90 percent of the losses to cotton and over half the losses to wheat occur in Texas. Most of the remaining wheat loss is in Oklahoma.

These examples serve to remind us that gross estimates of loss tell only part of the story. The estimated U.S. loss of $403 million represents only about 2¼ percent of the value of the crops included. The

Table 2—Average annual value of production and estimated hail losses to major U.S. crops, 1966-70

Crops	Average annual value of production[1] 1966-70	Estimated annual hail losses[1]
	Dollars	*Dollars*
Field Crops		
Barley	395,807,600	12,311,258
Corn for grain	5,502,495,400	73,167,575
Cotton:		
Lint	1,653,323,600	38,694,095
Seed	215,616,400	5,249,513
Dry beans	96,345,000	4,870,977
Dry peas	16,668,200	568,766
Flaxseed	73,470,800	2,630,294
Oats	555,603,400	14,351,757
Rye	30,095,600	1,424,855
Sorghum grain	849,506,000	15,297,216
Soybeans	2,703,486,000	53,881,235
Tobacco	1,288,650,200	38,587,596
Wheat	2,576,111,000	101,910,029
Fruit, vegetables and specialty crops		
Apples	290,073,400	11,765,517
Peaches	177,127,400	4,010,804
Potatoes	648,411,200	7,646,682
Sugar beets	298,950,200	7,350,355
Tomatoes:		
Fresh	199,067,800	3,109,230
Processing	199,851,800	1,563,216
Pears	67,487,400	1,927,701
Sweet cherries	32,794,600	1,152,969
Plums	19,146,200	1,399,137
Total	17,890,089,200	402,870,777

[1] Valued at 1968 prices.

real impact of the loss is absorbed by only part of the producers, and its impact on their economic and social situations can be determined only by further study.

For current or future evaluation of hail losses, proper interpretation of loss estimates expressed in value terms and based on 1968 prices must take into account the changes which have occurred in prices received by farmers since that time. A similar physical crop loss would represent considerably more value in more recent years of higher prices.

If one assumes a loss incidence similar to that experienced in the late 1960's, crop value lost in 1971, 1972, and 1973 may be approximated by use of an index of prices received by farmers for all crops.[5] The 1968 index of 229 may be used as representative of price levels in the base period. Indices of 242 for 1971, 261 for 1972, and 389 for 1973 represent increases in price levels of 5.7, 14.0, and 69.9 percent, respectively. Applying these rates of price increase to the loss estimate in the base period ($403 million) yields loss estimates of $426 million, $459 million, and $685 million in 1971, 1972, and 1973, respectively.

Although such figures must be considered as no more than approximations, they help avoid the error of considering any one figure as the annual loss of crop value due to hail. They may also be of value in determining justifiable levels of funding for research to develop hail suppression technology in the current crop situation of intense world demand and all-out production policies.

A rough idea of what reduction of these losses would be worth over a 20-year period is illustrated below. Two assumptions of price levels were used to provide a range

[5] Survey of Current Business, Dec. 1973, Vol. 53, No. 12. Indices for 1968, 1971, and 1972 are used as published. The 1973 index was derived by the author, using monthly price indices and monthly marketing volumes published in the same source.

Table 3—Estimated average annual crop losses due to hail, by crops, and share of total U.S. loss, 1966-70

Crop	Estimated average annual losses[1]	Shares of total U.S. losses	Cumulative shares of U.S. losses
	Dollars	*Percent*	*Percent*
Wheat	101,910,029	25.3	25.3
Corn for grain	73,167,575	18.2	43.5
Soybeans	53,881,235	13.4	56.9
Cotton lint	38,694,095	9.6	66.5
Tobacco	38,587,596	9.6	76.1
Sorghum grain	15,297,216	3.8	79.9
Oats	14,351,757	3.6	83.5
Barley	12,311,258	3.1	86.6
Apples	11,765,517	2.9	89.5
Potatoes	7,646,682	1.9	91.4
Sugar beets	7,350,355	1.8	93.2
Cotton seed	5,249,513	1.3	94.5
Dry beans	4,870,977	1.2	95.7
Peaches	4,010,804	1.0	96.7
Tomatoes-fresh	3,109,230	.7	97.4
Flaxseed	2,630,294	.7	98.1
Pears	1,927,701	.5	98.6
Tomatoes-processing	1,563,216	.4	99.0
Rye	1,424,855	.4	99.4
Plums	1,399,137	.3	99.7
Sweet cherries	1,152,969	.2	99.9
Dry peas	568,766	.1	100.0
Total	402,870,777	100.0	

[1] **Valued at 1968 prices.**

of estimates. Assumption I is that the predominant price level over the next 20 years will approximate 1973 levels as world demand continues to put pressure on production and distribution systems. This would result in an estimated annual loss valued at about $680 million.[6] Assumption II is that prices will average about what they did in 1968, resulting in annual losses of about $400 million.

Suppression technology reducing hail loss by 10 percent could produce "income" streams of $68 million and $40 million per year under these assumptions. If these "income" streams are discounted over 20 years at 7 percent (the approximate cost to the Federal Government of borrowing money) the present value of such savings would be $720 million under Assumption I and $424 million under Assumption II. A form of technology capable of reducing hail loss by 25 percent would produce annual "savings" of $170 million and $100 million under the respective high and low price assumptions. Still using the 7 percent discount rate, 20-year streams of these magnitudes discount to present values of $1,801 million and $1,059 million.

Values such as those above cannot be construed as justifiable levels of expenditure on research, because the procedure used to derive them totally disregarded any accounting of costs and adjustments related to the use of suppression technology. Their purpose here is to show that the benefits from even a small reduction in hail loss, if repeatable over time, *may be* substantially larger than the cost of developing the technology to produce it. There is also an implicit, and tantalizing, suggestion that even greater payoffs await the development of technology to reduce the larger losses caused by such weather-related phenomena as drought.

[6] Actual loss would be somewhat higher, because the all-out production policy would presumably increase acreage and output. Because such increases are difficult to estimate, and because this example is for illustration only, such differences are ignored.

APPENDIX A—AN ALTERNATE PROCEDURE FOR ESTIMATING HAIL LOSS

In personal communications following his review of an early draft of this manuscript, Stewart Borland, economist at the National Center for Atmospheric Research, outlined an alternative procedure for estimating crop loss due to hail. Briefly, it may be represented by the procedure in the box (all items refer to a given crop in a given area):

Alternate Procedure

1. $\frac{\text{Total insured liability}}{\text{Average insurance coverage per acre}}$ = Estimated number of insured acres

2. $\frac{\text{Number of insured acres damaged}}{\text{Number of insured acres}} \times 100$ = Estimated percent of insured acres damaged

3. $\text{Percent insured acres damaged} \times \text{planted acres}$ = Rate of loss on damaged acres

4. $\frac{\text{Losses paid per damaged insured acre}}{\text{Average insurance coverage per acre}}$ = Rate of loss on damaged acres

5. $\text{Rate of loss on damaged acres} \times \text{Estimated number of damaged acres}$ = Crude loss estimate

6. $\text{Crude loss estimate} \times \text{Ratio of potential crop value to average coverage per acre}$ = Adjusted loss estimate

Appendix Figure 1.

This procedure does not rely on the loss cost figure used in the author's approach. Its implicit assumptions regarding losses to insured and noninsured portions of the crop are essentially the same, however, and the user must contend with the same lack of information on that point, regardless of which approach he uses. More data are required in the Borland alternative, but most of them can be calculated from standard items in crop-hail insurance records.

The primary advantages of the Borland alternative are the extra information it generates about the number of acres included in the determination of the loss rate (compared to the estimate of total acres damaged), and the adjustment of the loss estimate by the relationship between potential crop value and average insurance coverage. The latter is one step toward compensation for the use of "minimum loss" and "excess over" clauses discussed with regard to the author's procedure.

Where resources permit the acquisition and processing of the necessary data, use of the Borland alternative would probably be advantageous, compared to the author's simpler approach. In the author's opinion, however, its advantage lies in the extra internal information it generates rather than in precision or accuracy. Improved quality of estimates of the cost of hail damage must await better information concerning the distribution of hail on noninsured crops.

APPENDIX B—ESTIMATED U.S. HAIL LOSSES BY STATES AND REGIONS, BY CROPS

Appendix table 1--Average annual value of production, hail insurance loss rates and estimated annual hail losses of major crops, by regions and States, 1966-70

Crops	Average annual value of production	Hail insurance loss rates	Estimated annual hail losses
	Dollars	Percent	Dollars
NEW ENGLAND			
Field Crops			
Barley			
Corn for Grain			
Cotton:			
Lint			
Seed			
Dry Beans			
Dry Peas			
Flaxseed			
Oats	1,455,400	--	1,389
Rye			
Sorghum Grain			
Soybeans			
Tobacco	36,256,800	--	1,375,929
Wheat			
Fruit, Vegetables and Speciality Crops			
Apples	20,044,200	--	701,814
Peaches	963,800	--	40,033
Potatoes	76,366,600	--	614,321
Sugar Beets			
Tomatoes:			
Fresh	3,624,600	--	33,780
Processing			
Total	138,701,400	--	2,767,266
MAINE			
Field Crops			
Barley			
Corn for Grain			
Cotton:			
Lint			
Seed			
Dry Beans			
Dry Peas			
Flaxseed			
Oats	1,156,400	.12	1,389
Rye			
Sorghum Grain			
Soybeans			
Tobacco			
Wheat			
Fruit, Vegetables and Specialty Crops			
Apples	3,973,400	3.40	139,851
Peaches			
Potatoes	66,179,400	.81	540,431
Sugar Beets			
Tomatoes:			
Fresh			
Processing			
Total	71,309,200		681,671

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Appendix table 1--Average annual value of production, hail insurance loss rates and estimated annual hail losses of major crops, by regions and States, 1966-70--Continued

Crops	Average annual value of production	Hail insurance loss rates	Estimated annual hail losses
NEW HAMPSHIRE	Dollars	Percent	Dollars
Field Crops			
Barley			
Corn for Grain			
Cotton:			
Lint			
Seed			
Dry Beans			
Dry Peas			
Flaxseed			
Oats			
Rye			
Sorghum Grain			
Soybeans			
Tobacco			
Wheat			
Fruit, Vegetables and Specialty Crops			
Apples	3,176,200	2.43	79,104
Peaches	60,000	--	--
Potatoes	639,000	--	--
Sugar Beets			
Tomatoes:			
Fresh			
Processing			
Total	3,875,200		79,104
VERMONT			
Field Crops			
Barley			
Corn for Grain			
Cotton:			
Lint			
Seed			
Dry Beans			
Dry Peas			
Flaxseed			
Oats	289,000	--	--
Rye			
Sorghum Grain			
Soybeans			
Tobacco			
Wheat			
Fruit, Vegetables and Specialty Crops			
Apples	2,850,400	3.08	90,582
Peaches			
Potatoes	726,200	--	--
Sugar Beets			
Tomatoes:			
Fresh			
Processing			
Total	3,865,600		90,582

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Appendix table 1--Average annual value of production, hail insurance loss rates and estimated annual hail losses of major crops, by regions and States, 1966-70--Continued

Crops	Average annual value of production	Hail insurance loss rates	Estimated annual hail losses
MASSACHUSETTS	Dollars	Percent	Dollars
Field Crops			
Barley			
Corn for Grain			
Cotton:			
Lint			
Seed			
Dry Beans			
Dry Peas			
Flaxseed			
Oats			
Rye			
Sorghum Grain			
Soybeans			
Tobacco	10,208,400	2.82	296,231
Wheat			
Fruit, Vegetables and Specialty Crops			
Apples	6,317,600	3.64	238,647
Peaches	301,200	1.82	5,583
Potatoes	2,643,600	1.02	27,243
Sugar Beets			
Tomatoes:			
Fresh	1,889,800	--	--
Processing			
Total	21,360,600		567,704
RHODE ISLAND			
Field Crops			
Barley			
Corn for Grain			
Cotton:			
Lint			
Seed			
Dry Beans			
Dry Peas			
Flaxseed			
Oats			
Rye			
Sorghum Grain			
Soybeans			
Tobacco			
Wheat			
Fruit, Vegetables and Specialty Crops			
Apples	372,600	5.02	19,693
Peaches	51,200	8.40	4,695
Potatoes	3,073,200	--	--
Sugar Beets			
Tomatoes:			
Fresh			
Processing			
Total	3,497,000		24,388

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Appendix table 1--Average annual value of production, hail insurance loss rates and estimated annual hail losses of major crops, by regions and States, 1966-70--Continued

Crops	Average annual value of production	Hail insurance loss rates	Estimated annual hail losses
CONNECTICUT	Dollars	Percent	Dollars
Field Crops			
Barley			
Corn for Grain			
Cotton:			
Lint			
Seed			
Dry Beans			
Dry Peas			
Flaxseed			
Oats			
Rye			
Sorghum Grain			
Soybeans			
Tobacco	26,048,400	3.98	1,079,698
Wheat			
Fruit, Vegetables and Specialty Crops			
Apples	3,354,000	3.84	133,937
Peaches	551,400	5.12	29,755
Potatoes	3,105,200	1.48	46,647
Sugar Beets			
Tomatoes:			
Fresh	1,734,800	1.91	33,780
Processing			
Total	34,793,800		1,323,817
MIDDLE ATLANTIC			
Field Crops			
Barley	10,832,200	--	109,787
Corn for Grain	121,221,000	--	387,707
Cotton:			
Lint			
Seed			
Dry Beans	9,057,800	--	83,183
Dry Peas			
Flaxseed			
Oats	34,798,800	--	397,448
Rye	1,269,200	--	2,878
Sorghum Grain			
Soybeans	4,468,200	--	--
Tobacco	10,623,600	--	320,667
Wheat	36,556,400	--	202,966
Fruit, Vegetables and Specialty Crops			
Apples	64,932,600	--	2,610,167
Peaches	14,697,600	--	527,227
Potatoes	71,846,600	--	439,595
Sugar Beets			
Tomatoes:			
Fresh	11,383,000	--	297,637
Processing	20,093,800	--	398,220
Total	411,780,800	--	5,777,482

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Appendix table 1--Average annual value of production, hail insurance loss rates and estimated annual hail losses of major crops, by regions and States, 1966-70--Continued

Crops	Average annual value of production	Hail insurance loss rates	Estimated annual hail losses
NEW YORK	Dollars	Percent	Dollars
Field Crops			
Barley	553,000	.53	2,947
Corn for Grain	25,649,200	.14	35,959
Cotton:			
Lint			
Seed			
Dry Beans	9,057,800	.91	83,183
Dry Peas			
Flaxseed			
Oats	17,391,600	1.57	277,403
Rye	476,800	.60	2,878
Sorghum Grain			
Soybeans	240,600	--	--
Tobacco			
Wheat	12,995,800	.32	41,720
Fruit, Vegetables and Specialty Crops			
Apples	41,725,200	4.14	1,802,027
Peaches	1,605,400	3.27	54,271
Potatoes	42,658,000	1.02	439,595
Sugar Beets			
Tomatoes:			
Fresh	3,140,600	2.53	81,520
Processing	2,832,600	1.69	48,694
Total	158,326,600		2,870,197
NEW JERSEY			
Field Crops			
Barley	1,095,600	--	--
Corn for Grain	5,731,800	--	--
Cotton:			
Lint			
Seed			
Dry Beans			
Dry Peas			
Flaxseed			
Oats	378,000	--	--
Rye	276,000	--	--
Sorghum Grain			
Soybeans	2,653,400	--	--
Tobacco			
Wheat	2,340,600	.13	3,047
Fruit, Vegetables and Specialty Crops			
Apples	5,745,800	1.19	69,198
Peaches	7,303,200	1.82	135,382
Potatoes	8,179,000	--	--
Sugar Beets			
Tomatoes:			
Fresh	6,096,000	2.62	164,012
Processing	11,579,600	1.68	197,861
Total	51,379,000		569,500

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Appendix table 1--Average annual value of production, hail insurance loss rates and estimated annual hail losses of major crops, by regions and States, 1966-70--Continued

Crops	Average annual value of production	Hail insurance loss rates	Estimated annual hail losses
PENNSYLVANIA	Dollars	Percent	Dollars
Field Crops			
Barley	9,183,600	1.15	106,840
Corn for Grain	89,840,000	.39	351,748
Cotton:			
Lint			
Seed			
Dry Beans			
Dry Peas			
Flaxseed			
Oats	17,029,200	.70	120,045
Rye	516,400	--	--
Sorghum Grain			
Soybeans	1,574,200	--	--
Tobacco	10,623,600	2.93	320,667
Wheat	21,220,000	.74	158,199
Fruit, Vegetables and Specialty Crops			
Apples	17,461,600	4.06	738,942
Peaches	5,789,000	5.51	337,574
Potatoes	21,009,600	--	--
Sugar Beets			
Tomatoes:			
Fresh	2,146,400	2.37	52,105
Processing	5,681,600	2.60	151,665
Total	202,075,200		2,337,785
EAST NORTH CENTRAL			
Field Crops			
Barley	4,327,400	--	34,604
Corn for Grain	2,225,184,600	--	12,028,295
Cotton:			
Lint			
Seed			
Dry Beans			
Dry Peas			
Flaxseed			
Oats	150,798,400	--	1,455,517
Rye	2,813,800	--	37,633
Sorghum Grain	1,271,200	--	3,537
Soybeans	951,710,200	--	12,283,818
Tobacco	29,494,200	--	967,267
Wheat	287,086,000	--	1,949,694
Fruit, Vegetables and Specialty Crops			
Apples	48,902,400	--	1,845,525
Peaches	8,499,600	--	279,632
Potatoes	65,763,400	--	861,303
Sugar Beets	7,677,600	--	27,739
Tomatoes:			
Fresh	8,938,400	--	250,148
Processing	34,319,800	--	858,366
Total	3,826,787,000	--	32,883,078

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Appendix table 1--Average annual value of production, hail insurance loss rates and estimated annual hail losses of major crops, by regions and States, 1966-70--Continued

Crops	Average annual value of production	Hail insurance loss rates	Estimated annual hail losses
OHIO	Dollars	Percent	Dollars
Field Crops			
Barley	695,200	.19	1,323
Corn for Grain	302,829,000	.39	1,185,657
Cotton:			
Lint			
Seed			
Dry Beans			
Dry Peas			
Flaxseed			
Oats	21,585,200	.82	178,462
Rye	404,400	.35	1,420
Sorghum Grain			
Soybeans	162,898,400	.83	1,363,373
Tobacco	13,320,400	2.34	319,166
Wheat	76,430,000	.48	368,633
Fruit, Vegetables and Specialty Crops			
Apples	7,696,800	4.97	402,537
Peaches	1,501,000	3.63	56,539
Potatoes	7,116,000	.01	712
Sugar Beets	7,677,600	.36	27,739
Tomatoes:			
Fresh	1,499,600	3.47	53,907
Processing	18,286,000	2.18	407,519
Total	621,939,600		4,366,987
INDIANA			
Field Crops			
Barley	382,200	1.88	7,323
Corn for Grain	504,793,000	.44	2,230,905
Cotton:			
Lint			
Seed			
Dry Beans			
Dry Peas			
Flaxseed			
Oats	11,661,800	1.20	141,641
Rye	508,800	1.13	5,815
Sorghum Grain	716,200	.26	1,867
Soybeans	232,814,400	1.18	2,780,014
Tobacco	9,969,800	2.21	225,312
Wheat	62,980,000	.90	571,968
Fruit, Vegetables and Specialty Crops			
Apples	4,298,000	3.37	149,894
Peaches	764,000	3.13	24,686
Potatoes	4,385,200	.03	1,316
Sugar Beets			
Tomatoes:			
Fresh	2,410,600	2.62	64,857
Processing	10,055,600	1.94	198,938
Total	845,739,600		6,404,536

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Appendix table 1--Average annual value of production, hail insurance loss rates and estimated annual hail losses of major crops, by regions and States, 1966-70--Continued

Crops	Average annual value of production	Hail insurance loss rates	Estimated annual hail losses
ILLINOIS	Dollars	Percent	Dollars
Field Crops			
Barley	607,600	.73	4,468
Corn for Grain	1,110,152,000	.64	7,150,730
Cotton:			
Lint			
Seed			
Dry Beans			
Dry Peas			
Flaxseed			
Oats	28,871,600	1.05	306,369
Rye	609,600	1.19	7,342
Sorghum Grain	555,000	.30	1,670
Soybeans	517,447,400	1.44	7,560,108
Tobacco			
Wheat	93,113,800	.77	722,540
Fruit, Vegetables and Specialty Crops			
Apples	5,157,800	5.68	310,605
Peaches	1,507,200	3.75	58,722
Potatoes	980,200	.04	392
Sugar Beets			
Tomatoes:			
Fresh	834,800	4.25	37,054
Processing	3,500,600	4.25	155,379
Total	1,763,337,600		16,315,379
MICHIGAN			
Field Crops			
Barley	831,000	.25	2,083
Corn for Grain	120,106,200	.18	216,581
Cotton:			
Lint			
Seed			
Dry Beans			
Dry Peas			
Flaxseed			
Oats	17,479,000	.46	80,775
Rye	879,400	.07	616
Sorghum Grain			
Soybeans	29,925,800	1.61	489,689
Tobacco			
Wheat	51,811,400	.47	244,663
Fruit, Vegetables and Specialty Crops			
Apples	27,870,400	2.63	752,790
Peaches	4,727,400	2.87	139,685
Potatoes	21,730,200	--	--
Sugar Beets			
Tomatoes:			
Fresh	4,193,400	2.20	94,330
Processing	2,477,600	3.75	96,530
Total	282,031,800		2,117,742

--continued

Appendix table 1--Average annual value of production, hail insurance loss rates and estimated annual hail losses of major crops, by regions and States, 1966-70--Continued

Crops	Average annual value of production	Hail insurance loss rates	Estimated annual hail losses
WISCONSIN	Dollars	Percent	Dollars
Field Crops			
Barley	1,811,400	1.06	19,407
Corn for Grain	187,304,400	.66	1,244,422
Cotton:			
Lint			
Seed			
Dry Beans			
Dry Peas			
Flaxseed			
Oats	71,200,800	1.40	748,270
Rye	411,600	5.17	22,440
Sorghum Grain			
Soybeans	8,624,200	1.04	90,634
Tobacco	6,204,000	6.38	422,789
Wheat	2,750,800	1.50	41,890
Fruit, Vegetables and Specialty Crops			
Apples	3,879,400	5.59	229,699
Peaches			
Potatoes	31,551,800	2.65	858,883
Sugar Beets			
Tomatoes:			
Fresh			
Processing			
Total	313,738,400		3,678,434
WEST NORTH CENTRAL			
Field Crops			
Barley	124,179,200	--	5,177,356
Corn for Grain	2,533,610,800	--	55,318,236
Cotton:			
Lint	37,750,200	--	719,381
Seed	4,721,400	--	89,973
Dry Beans	13,964,000	--	2,505,140
Dry Peas	418,800	--	34,999
Flaxseed	70,732,800	--	2,581,150
Oats	300,840,400	--	10,816,441
Rye	16,599,200	--	1,039,432
Sorghum Grain	330,268,400	--	4,514,763
Soybeans	963,653,400	--	37,348,684
Tobacco	3,548,000	--	155,936
Wheat	1,177,633,800	--	56,165,873
Fruit, Vegetables and Specialty Crops			
Apples	6,143,600	--	684,781
Peaches	1,620,400	--	88,526
Potatoes	53,117,800	--	1,223,120
Sugar Beets	61,877,000	--	3,586,673
Tomatoes:			
Fresh			
Processing			
Total	5,700,679,200	--	182,050,464

--continued

Appendix table 1--Average annual value of production, hail insurance loss rates and estimated annual hail losses of major crops, by regions and States, 1966-70--Continued

Crops	Average annual value of production	Hail insurance loss rates	Estimated annual hail losses
MINNESOTA	Dollars	Percent	Dollars
Field Crops			
Barley	27,087,200	3.45	967,901
Corn for Grain	438,034,000	2.33	10,449,669
Cotton:			
Lint			
Seed			
Dry Beans	576,800	1.02	5,944
Dry Peas	287,000	7.08	21,868
Flaxseed	12,552,600	2.65	341,699
Oats	99,470,600	2.99	3,065,840
Rye	1,960,600	3.43	69,637
Sorghum Grain			
Soybeans	193,911,800	5.41	11,090,632
Tobacco			
Wheat	50,709,200	2.56	1,332,261
Fruit, Vegetables and Specialty Crops			
Apples	1,453,600	8.55	135,902
Peaches			
Potatoes	23,343,200	1.63	386,799
Sugar Beets	25,604,600	2.75	724,038
Tomatoes:			
Fresh			
Processing			
Total	874,991,200		28,592,190
IOWA			
Field Crops			
Barley	176,000	3.61	6,592
Corn for Grain	1,133,473,400	1.61	18,547,537
Cotton:			
Lint			
Seed			
Dry Beans			
Dry Peas			
Flaxseed	98,200	3.57	3,636
Oats	65,063,600	3.06	2,053,792
Rye	102,200	1.61	1,672
Sorghum Grain	2,840,800	.70	20,026
Soybeans	427,562,800	4.20	18,744,924
Tobacco			
Wheat	2,716,600	1.86	51,486
Fruit, Vegetables and Specialty Crops			
Apples	986,800	12.08	135,584
Peaches			
Potatoes	1,278,600	1.36	17,629
Sugar Beets			
Tomatoes:			
Fresh			
Processing			
Total	1,634,299,000		39,582,878

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Appendix table 1--Average annual value of production, hail insurance loss rates and estimated annual hail losses of major crops, by regions and States, 1966-70--Continued

Crops	Average annual value of production	Hail insurance loss rates	Estimated annual hail losses
MISSOURI	Dollars	Percent	Dollars
Field Crops			
Barley	826,200	2.90	24,675
Corn for Grain	262,631,800	1.04	2,760,076
Cotton:			
Lint	37,750,200	1.87	719,381
Seed	4,721,400	1.87	89,973
Dry Beans			
Dry Peas			
Flaxseed			
Oats	6,564,600	1.30	86,464
Rye	387,000	1.96	7,737
Sorghum Grain	15,104,600	.18	27,237
Soybeans	220,598,200	1.38	3,086,854
Tobacco	3,548,000	4.21	155,936
Wheat	65,619,000	1.61	1,073,753
Fruit, Vegetables and Specialty Crops			
Apples	3,158,200	9.25	321,910
Peaches	1,173,200	6.29	78,747
Potatoes	523,600	.62	3,267
Sugar Beets			
Tomatoes:			
Fresh			
Processing			
Total	622,606,000		8,436,010
NORTH DAKOTA			
Field Crops			
Barley	79,965,200	4.03	3,357,922
Corn for Grain	10,867,800	3.04	340,740
Cotton:			
Lint			
Seed			
Dry Beans	1,624,400	2.97	49,721
Dry Peas	131,800	9.06	13,131
Flaxseed	37,979,600	3.80	1,500,234
Oats	53,196,000	4.07	2,256,934
Rye	4,492,600	6.39	306,674
Sorghum Grain			
Soybeans	8,929,200	5.33	502,721
Tobacco			
Wheat	350,899,800	4.63	17,035,400
Fruit, Vegetables and Specialty Crops			
Apples			
Peaches			
Potatoes	23,646,000	2.31	559,139
Sugar Beets	11,999,800	2.46	302,640
Tomatoes:			
Fresh			
Processing			
Total	583,732,200		26,225,256

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Appendix table 1--Average annual value of production, hail insurance loss rates and estimated annual hail losses of major crops, by regions and States, 1966-70--Continued

Crops	Average annual value of production	Hail insurance loss rates	Estimated annual hail losses
SOUTH DAKOTA	Dollars	Percent	Dollars
Field Crops			
Barley	10,396,600	4.16	451,271
Corn for Grain	140,638,400	3.73	5,449,062
Cotton:			
Lint			
Seed			
Dry Beans			
Dry Peas			
Flaxseed	20,102,400	3.53	735,581
Oats	57,708,600	4.42	2,668,676
Rye	6,174,800	5.76	377,407
Sorghum Grain	10,226,000	2.33	243,950
Soybeans	14,192,000	6.26	947,748
Tobacco			
Wheat	97,059,000	5.23	5,356,321
Fruit, Vegetables and Specialty Crops			
Apples			
Peaches			
Potatoes	1,286,800	1.51	19,729
Sugar Beets			
Tomatoes:			
Fresh			
Processing			
Total	357,784,600		16,249,745
NEBRASKA			
Field Crops			
Barley	1,103,600	7.98	95,704
Corn for Grain	448,903,000	3.46	16,088,713
Cotton:			
Lint			
Seed			
Dry Beans	10,621,000	17.90	2,315,663
Dry Peas			
Flaxseed			
Oats	13,703,000	3.77	536,842
Rye	2,611,600	8.11	230,494
Sorghum Grain	124,186,400	1.52	1,916,768
Soybeans	50,366,800	4.64	2,450,734
Tobacco			
Wheat	159,218,800	5.88	9,946,946
Fruit, Vegetables and Specialty Crops			
Apples			
Peaches			
Potatoes	2,682,400	7.36	213,109
Sugar Beets	17,419,800	10.40	2,021,941
Tomatoes:			
Fresh			
Processing			
Total	830,816,400		35,816,914

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Appendix table 1--Average annual value of production, hail insurance loss rates and estimated annual hail losses of major crops, by regions and States, 1966-70--Continued

Crops	Average annual value of production	Hail insurance loss rates	Estimated annual hail losses
KANSAS	Dollars	Percent	Dollars
Field Crops			
Barley	4,624,400	5.58	273,291
Corn for Grain	99,062,400	1.67	1,682,439
Cotton:			
Lint			
Seed			
Dry Beans	1,141,800	10.49	133,812
Dry Peas			
Flaxseed			
Oats	5,134,000	2.80	147,893
Rye	870,400	5.00	45,811
Sorghum Grain	177,910,600	1.28	2,306,782
Soybeans	48,092,600	1.08	525,071
Tobacco			
Wheat	451,411,400	4.52	21,369,706
Fruit, Vegetables and Specialty Crops			
Apples	545,000	14.36	91,385
Peaches	447,200	2.14	9,779
Potatoes	357,200	6.16	23,448
Sugar Beets	6,852,800	7.28	538,054
Tomatoes:			
Fresh			
Processing			
Total	796,449,800		27,147,471
SOUTH ATLANTIC			
Field Crops			
Barley	14,747,600	--	135,711
Corn for Grain	344,800,800	--	1,950,295
Cotton:			
Lint	119,942,200	--	1,909,449
Seed	13,009,000	--	206,440
Dry Beans			
Dry Peas			
Flaxseed			
Oats	14,664,400	--	133,830
Rye	5,316,800	--	82,536
Sorghum Grain	4,181,400	--	--
Soybeans	184,533,800	--	1,092,741
Tobacco	838,193,800	--	24,618,420
Wheat	42,786,000	--	342,042
Fruit, Vegetables and Specialty Crops			
Apples	38,461,600	--	2,054,727
Peaches	40,559,000	--	1,914,061
Potatoes	43,323,000	--	42,753
Sugar Beets			
Tomatoes:			
Fresh	86,983,600	--	1,645,693
Processing	6,560,200	--	139,060
Total	1,798,063,200	--	36,267,758

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Appendix table 1--Average annual value of production, hail insurance loss rates and estimated annual hail losses of major crops, by regions and States, 1966-70--Continued

Crops	Average annual value of production	Hail insurance loss rates	Estimated annual hail losses
DELAWARE	Dollars	Percent	Dollars
Field Crops			
Barley	818,200	--	--
Corn for Grain	15,303,000	.33	50,667
Cotton:			
Lint			
Seed			
Dry Beans			
Dry Peas			
Flaxseed			
Oats	98,800	--	--
Rye	248,200	--	--
Sorghum Grain			
Soybeans	8,362,800	.88	74,246
Tobacco			
Wheat	1,311,000	.70	9,242
Fruit, Vegetables and Specialty Crops			
Apples	570,600	2.55	14,931
Peaches	264,600	5.87	16,501
Potatoes	3,515,800	--	--
Sugar Beets			
Tomatoes:			
Fresh			
Processing			
Total	30,493,000	--	165,587
MARYLAND			
Field Crops			
Barley	3,962,000	.73	29,135
Corn for Grain	44,590,200	.35	156,614
Cotton:			
Lint			
Seed			
Dry Beans			
Dry Peas			
Flaxseed			
Oats	1,025,200	.26	2,672
Rye	459,800	2.44	11,500
Sorghum Grain			
Soybeans	12,813,800	.30	38,557
Tobacco	20,878,800	.81	170,499
Wheat	7,200,600	.44	31,823
Fruit, Vegetables and Specialty Crops			
Apples	3,547,800	5.39	202,121
Peaches	1,376,600	2.79	39,509
Potatoes	865,400	--	--
Sugar Beets			
Tomatoes:			
Fresh	1,702,200	--	--
Processing	2,857,800	1.79	52,087
Total	101,280,200	--	734,517

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Appendix table 1--Average annual value of production, hail insurance loss rates and estimated annual hail losses of major crops, by regions and States, 1966-70--Continued

Crops	Average annual value of production	Hail insurance loss rates	Estimated annual hail losses
VIRGINIA	Dollars	Percent	Dollars
Field Crops			
Barley	5,549,000	1.33	74,796
Corn for Grain	43,039,600	.36	155,502
Cotton:			
Lint			
Seed			
Dry Beans			
Dry Peas			
Flaxseed			
Oats	1,935,200	1.28	25,092
Rye	672,400	1.66	11,350
Sorghum Grain	592,400	--	--
Soybeans	19,171,800	.19	36,496
Tobacco	84,114,600	2.89	2,503,256
Wheat	10,016,400	.99	100,154
Fruit, Vegetables and Specialty Crops			
Apples	15,940,200	3.93	652,076
Peaches	2,089,600	5.16	113,690
Potatoes	10,895,600	--	--
Sugar Beets			
Tomatoes:			
Fresh	3,671,200	3.08	116,666
Processing	1,825,000	3.08	57,996
Total	199,513,000	--	3,847,074
WEST VIRGINIA			
Field Crops			
Barley	426,200	--	--
Corn for Grain	4,008,200	.99	40,078
Cotton:			
Lint			
Seed			
Dry Beans			
Dry Peas			
Flaxseed			
Oats	483,200	.02	97
Rye			
Sorghum Grain			
Soybeans			
Tobacco	2,379,000	--	--
Wheat	824,200	.40	3,310
Fruit, Vegetables and Specialty Crops			
Apples	10,318,200	2.17	228,871
Peaches	1,081,200	4.64	52,609
Potatoes	982,800	--	--
Sugar Beets			
Tomatoes:			
Fresh			
Processing			
Total	20,503,000	--	324,965

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Appendix table 1--Average annual value of production, hail insurance loss rates and estimated annual hail losses of major crops, by regions and States, 1966-70--Continued

Crops	Average annual value of production	Hail insurance loss rates	Estimated annual hail losses
NORTH CAROLINA	Dollars	Percent	Dollars
Field Crops			
Barley	2,875,200	.76	22,019
Corn for Grain	108,673,000	.44	480,274
Cotton:			
Lint	20,527,400	1.28	266,158
Seed	2,199,400	1.28	28,517
Dry Beans			
Dry Peas			
Flaxseed			
Oats	4,754,600	.69	33,035
Rye	507,000	3.10	16,220
Sorghum Grain	2,681,800	--	--
Soybeans	58,065,400	.34	198,096
Tobacco	519,857,400	2.68	14,315,843
Wheat	12,346,800	.79	98,316
Fruit, Vegetables and Specialty Crops			
Apples	7,435,600	10.35	858,432
Peaches	4,226,200	2.37	102,592
Potatoes	5,582,600	.76	42,753
Sugar Beets			
Tomatoes:			
Fresh	3,424,600	3.11	109,924
Processing			
Total	753,157,000	--	16,572,179
SOUTH CAROLINA			
Field Crops			
Barley	805,400	.73	6,741
Corn for Grain	23,950,800	1.38	335,146
Cotton:			
Lint	46,704,600	1.88	894,870
Seed	4,926,000	1.88	94,383
Dry Beans			
Dry Peas			
Flaxseed			
Oats	2,760,600	1.82	51,174
Rye	678,200	1.42	9,769
Sorghum Grain	301,800	--	--
Soybeans	50,405,200	1.31	669,073
Tobacco	95,408,200	3.82	3,789,346
Wheat	4,767,400	1.21	58,392
Fruit, Vegetables and Specialty Crops			
Apples	649,200	13.15	98,296
Peaches	19,203,200	4.94	997,936
Potatoes			
Sugar Beets			
Tomatoes:			
Fresh	6,253,400	4.33	283,027
Processing			
Total	256,814,000	--	7,288,153

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Appendix table 1--Average annual value of production, hail insurance loss rates and estimated annual hail losses of major crops, by regions and States, 1966-70--Continued

Crops	Average annual value of production	Hail insurance loss rates	Estimated annual hail losses
GEORGIA	Dollars	Percent	Dollars
Field Crops			
Barley	311,600	.96	3,020
Corn for Grain	84,750,400	.78	666,250
Cotton:			
Lint	52,710,200	1.40	748,421
Seed	5,883,600	1.40	83,540
Dry Beans			
Dry Peas			
Flaxseed			
Oats	3,226,000	.67	21,760
Rye	2,751,200	1.21	33,697
Sorghum Grain	605,400	--	--
Soybeans	26,224,800	.29	76,273
Tobacco	85,530,800	3.72	3,304,680
Wheat	4,817,400	.80	38,850
Fruit, Vegetables and Specialty Crops			
Apples			
Peaches	12,317,600	4.58	591,224
Potatoes			
Sugar Beets			
Tomatoes:			
Fresh	1,351,000	3.34	46,683
Processing			
Total	280,480,000	--	5,614,398
FLORIDA			
Field Crops			
Barley			
Corn for Grain	20,485,600	.32	65,764
Cotton:			
Lint			
Seed			
Dry Beans			
Dry Peas			
Flaxseed			
Oats	380,800	--	--
Rye			
Sorghum Grain			
Soybeans	9,490,000	--	--
Tobacco	30,025,000	1.75	534,796
Wheat	1,502,200	.13	1,955
Fruit, Vegetables and Specialty Crops			
Apples			
Peaches			
Potatoes	21,480,800	--	--
Sugar Beets			
Tomatoes:			
Fresh	70,581,200	1.52	1,089,393
Processing	1,877,400	1.52	28,977
Total	155,823,000	--	1,720,885

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Appendix table 1--Average annual value of production, hail insurance loss rates and estimated annual hail losses of major crops, by regions and States, 1966-70--Continued

Crops	Average annual value of production	Hail insurance loss rates	Estimated annual hail losses
EAST SOUTH CENTRAL	Dollars	Percent	Dollars
Field Crops			
Barley	2,395,000	--	10,608
Corn for Grain	190,905,400	--	443,989
Cotton:			
Lint	374,266,400	--	2,419,792
Seed	47,430,400	--	297,470
Dry Beans			
Dry Peas			
Flaxseed			
Oats	5,359,400	--	25,787
Rye	392,000	--	--
Sorghum Grain	4,070,800	--	10,056
Soybeans	260,979,400	--	412,540
Tobacco	370,426,200	--	11,149,377
Wheat	35,371,800	--	304,124
Fruit, Vegetables and Specialty Crops			
Apples	1,451,000	--	178,929
Peaches	5,792,000	--	60,812
Potatoes	9,292,600	--	12,416
Sugar Beets			
Tomatoes:			
Fresh	6,987,600	--	156,439
Processing			
Total	1,315,120,000	--	15,482,339
KENTUCKY			
Field Crops			
Barley	1,786,800	.57	10,243
Corn for Grain	94,259,400	.25	236,239
Cotton:			
Lint			
Seed			
Dry Beans			
Dry Peas			
Flaxseed			
Oats	636,800	.66	4,231
Rye	239,600	--	--
Sorghum Grain	471,400	--	--
Soybeans	30,362,000	--	--
Tobacco	290,093,000	3.15	9,435,136
Wheat	10,013,000	.56	56,389
Fruit, Vegetables and Specialty Crops			
Apples	1,013,000	10.38	117,328
Peaches	973,800	.15	1,463
Potatoes	763,600	1.60	12,416
Sugar Beets			
Tomatoes:			
Fresh	753,400	8.24	67,655
Processing			
Total	431,365,800	--	9,941,100

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Appendix table 1--Average annual value of production, hail insurance loss rates and estimated annual hail losses of major crops, by regions and States, 1966-70--Continued

Crops	Average annual value of production	Hail insurance loss rates	Estimated annual hail losses
TENNESSEE	Dollars	Percent	Dollars
Field Crops			
Barley	608,200	.06	365
Corn for Grain	44,763,800	.19	85,213
Cotton:			
Lint	60,788,400	1.28	788,180
Seed	7,205,000	1.28	93,420
Dry Beans			
Dry Peas			
Flaxseed			
Oats	1,571,800	.34	5,362
Rye	152,400	--	--
Sorghum Grain	674,000	1.47	10,056
Soybeans	66,192,000	.44	292,532
Tobacco	79,733,200	2.09	1,701,996
Wheat	10,424,600	1.77	187,840
Fruit, Vegetables and Specialty Crops			
Apples	438,000	12.33	61,601
Peaches	497,400	10.66	59,349
Potatoes	1,397,200	--	--
Sugar Beets			
Tomatoes:			
Fresh	2,278,800	3.75	88,784
Processing			
Total	276,724,800	--	3,374,698
ALABAMA			
Field Crops			
Barley			
Corn for Grain	32,995,600	.37	122,537
Cotton:			
Lint	76,406,200	.82	631,711
Seed	8,491,200	.82	70,204
Dry Beans			
Dry Peas			
Flaxseed			
Oats	892,200	.54	4,844
Rye			
Sorghum Grain	501,600	--	--
Soybeans	31,203,600	--	--
Tobacco	600,000	2.00	12,245
Wheat	3,512,600	.30	10,570
Fruit, Vegetables and Specialty Crops			
Apples			
Peaches	3,203,400	--	--
Potatoes	6,400,600	--	--
Sugar Beets			
Tomatoes:			
Fresh	3,955,400	--	--
Processing			
Total	168,162,400	--	852,111

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Appendix table 1--Average annual value of production, hail insurance loss rates and estimated annual hail losses of major crops, by regions and States, 1966-70--Continued

Crops	Average annual value of production	Hail insurance loss rates	Estimated annual hail losses
MISSISSIPPI	Dollars	Percent	Dollars
Field Crops			
Barley	18,886,600	--	--
Corn for Grain			
Cotton:			
Lint	237,071,800	.42	999,901
Seed	31,734,200	.42	133,846
Dry Beans			
Dry Peas			
Flaxseed			
Oats	2,258,600	.50	11,350
Rye			
Sorghum Grain	2,423,800	--	--
Soybeans	133,221,800	.09	120,008
Tobacco			
Wheat	11,421,600	.43	49,325
Fruit, Vegetables and Specialty Crops			
Apples			
Peaches	1,117,400	--	--
Potatoes	731,200	--	--
Sugar Beets			
Tomatoes:			
Fresh			
Processing			
Total	438,867,000	--	1,314,430
WEST SOUTH CENTRAL			
Field Crops			
Barley	13,715,800	--	996,237
Corn for Grain	13,770,800	--	429,602
Cotton:			
Lint	770,314,000	--	29,279,037
Seed	105,712,600	--	4,107,138
Dry Beans			
Dry Peas			
Flaxseed	2,051,400	--	29,549
Oats	22,639,200	--	759,698
Rye	1,395,600	--	122,399
Sorghum Grain	416,150,800	--	9,649,799
Soybeans	338,141,000	--	2,743,452
Tobacco	107,600	--	--
Wheat	5,538,400	--	19,524,435
Fruit, Vegetables and Specialty Crops			
Apples	411,200	--	56,179
Peaches	6,690,200	--	680,096
Potatoes	16,081,200	--	753,614
Sugar Beets	7,470,800	--	166,493
Tomatoes:			
Fresh	11,078,800	--	656,707
Processing	1,402,400	--	44,716
Total	2,072,671,800	--	69,999,151

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Appendix table 1--Average annual value of production, hail insurance loss rates and estimated annual hail losses of major crops, by regions and States, 1966-70--Continued

Crops	Average annual value of production	Hail insurance loss rates	Estimated annual hail losses
ARKANSAS	Dollars	Percent	Dollars
Field Crops			
Barley	77,800	3.32	2,672
Corn for Grain	2,733,200	2.66	74,690
Cotton:			
Lint	158,098,800	1.45	2,326,162
Seed	19,806,000	1.45	291,412
Dry Beans			
Dry Peas			
Flaxseed			
Oats	3,554,600	1.35	48,644
Rye			
Sorghum Grain	4,192,000	.80	33,806
Soybeans	233,002,200	.76	1,784,378
Tobacco			
Wheat	17,774,200	1.66	300,032
Fruit, Vegetables and Specialty Crops			
Apples	411,200	12.02	56,179
Peaches	2,927,800	4.52	138,601
Potatoes	459,000	5.64	27,435
Sugar Beets			
Tomatoes:			
Fresh	4,723,400	9.07	471,145
Processing			
Total	447,760,200	--	5,555,156
LOUISIANA			
Field Crops			
Barley			
Corn for Grain	7,428,800	3.44	264,655
Cotton:			
Lint	81,201,600	.09	73,147
Seed	10,731,800	.09	9,667
Dry Beans			
Dry Peas			
Flaxseed			
Oats	1,063,800	.75	8,039
Rye			
Sorghum Grain	1,494,800	--	--
Soybeans	82,572,800	--	--
Tobacco	107,600	--	--
Wheat	2,485,200	--	--
Fruit, Vegetables and Specialty Crops			
Apples			
Peaches	765,400	--	--
Potatoes	423,400	--	--
Sugar Beets			
Tomatoes:			
Fresh	1,515,800	2.02	31,250
Processing			
Total	189,791,000	--	386,758

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Appendix table 1--Average annual value of production, hail insurance loss rates and estimated annual hail losses of major crops, by regions and States, 1966-70--Continued

Crops	Average annual value of production	Hail insurance loss rates	Estimated annual hail losses
OKLAHOMA	Dollars	Percent	Dollars
Field Crops			
Barley	10,863,000	6.76	787,579
Corn for Grain	3,608,800	2.44	90,257
Cotton:			
Lint	37,178,600	3.58	1,380,413
Seed	5,212,600	3.58	193,540
Dry Beans			
Dry Peas			
Flaxseed			
Oats	3,829,400	4.36	174,573
Rye	819,000	6.22	54,321
Sorghum Grain	28,087,200	3.22	934,499
Soybeans	8,125,000	1.03	84,558
Tobacco			
Wheat	195,442,800	4.55	9,316,550
Fruit, Vegetables and Specialty Crops			
Apples			
Peaches	642,800	--	--
Potatoes			
Sugar Beets			
Tomatoes:			
Fresh			
Processing			
Total	293,809,200	--	13,016,290
TEXAS			
Field Crops			
Barley	2,775,000	6.91	205,986
Corn for Grain	--	2.47	--
Cotton:			
Lint	493,835,000	4.91	25,499,315
Seed	69,962,200	4.91	3,612,519
Dry Beans			
Dry Peas			
Flaxseed	2,051,400	1.42	29,549
Oats	14,191,400	3.59	528,442
Rye	576,600	10.56	68,078
Sorghum Grain	382,376,800	2.22	8,681,494
Soybeans	14,441,000	5.71	874,516
Tobacco			
Wheat	129,836,200	7.09	9,907,853
Fruit, Vegetables and Specialty Crops			
Apples			
Peaches	2,354,200	18.70	541,495
Potatoes	15,198,800	4.56	726,179
Sugar Beets	7,470,800	2.18	166,493
Tomatoes:			
Fresh	4,839,600	3.09	154,312
Processing	1,402,400	3.09	44,716
Total	1,141,311,400	--	51,040,947

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Appendix table 1--Average annual value of production, hail insurance loss rates and estimated annual hail losses of major crops, by regions and States, 1966-70--Continued

Crops	Average annual value of production	Hail insurance loss rates	Estimated annual hail losses
MOUNTAIN	Dollars	Percent	Dollars
Field Crops			
Barley	116,418,400	--	4,570,367
Corn for Grain	40,818,400	--	2,596,881
Cotton:			
Lint	128,310,200	--	4,121,152
Seed	16,131,200	--	516,984
Dry Beans	33,952,600	--	2,226,740
Dry Peas	8,088,000	--	422,101
Flaxseed	434,000	--	19,595
Oats	14,633,000	--	671,135
Rye	1,141,600	--	123,340
Sorghum Grain	56,974,600	--	1,119,061
Soybeans			
Tobacco			
Wheat	394,083,600	--	22,118,104
Fruit, Vegetables and Specialty Crops			
Apples	9,940,800	--	1,305,962
Peaches	3,012,000	--	56,440
Potatoes	167,319,400	--	2,986,048
Sugar Beets	114,115,400	--	3,424,057
Tomatoes:			
Fresh	444,600	--	56,640
Processing	1,710,600	--	122,854
Total	1,107,528,400	--	46,457,461
MONTANA			
Field Crops			
Barley	48,638,200	5.03	2,576,078
Corn for Grain	754,400	5.36	42,726
Cotton:			
Lint			
Seed			
Dry Beans	1,191,600	11.08	148,481
Dry Peas			
Flaxseed	434,000	4.32	19,595
Oats	5,901,400	5.44	339,505
Rye	95,000	8.54	8,871
Sorghum Grain			
Soybeans			
Tobacco			
Wheat	182,832,600	5.13	9,886,489
Fruit, Vegetables and Specialty Crops			
Apples			
Peaches			
Potatoes	4,614,800	1.32	61,730
Sugar Beets	14,851,000	6.81	1,085,259
Tomatoes:			
Fresh			
Processing			
Total	259,313,000	--	14,168,734

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Appendix table 1--Average annual value of production, hail insurance loss rates and estimated annual hail losses of major crops, by regions and States, 1966-70--Continued

Crops	Average annual value of production	Hail insurance loss rates	Estimated annual hail losses
IDAHO	Dollars	Percent	Dollars
Field Crops			
Barley	28,435,000	2.36	687,286
Corn for Grain	2,806,200	.50	14,102
Cotton:			
Lint			
Seed			
Dry Beans	13,401,000	2.19	300,053
Dry Peas	8,088,000	4.96	422,101
Flaxseed			
Oats	2,846,400	1.45	41,880
Rye	228,800	.85	1,961
Sorghum Grain			
Soybeans			
Tobacco			
Wheat	86,128,800	1.78	1,560,876
Fruit, Vegetables and Specialty Crops			
Apples	4,015,000	4.38	183,912
Peaches	730,400	.84	6,187
Potatoes	129,062,800	1.73	2,272,094
Sugar Beets	42,645,400	2.98	1,309,867
Tomatoes:			
Fresh			
Processing			
Total	318,387,800	--	6,800,319
WYOMING			
Field Crops			
Barley	5,068,200	3.45	181,101
Corn for Grain	1,774,200	1.92	34,731
Cotton:			
Lint			
Seed			
Dry Beans	4,153,000	4.08	176,650
Dry Peas			
Flaxseed			
Oats	2,395,600	5.01	126,350
Rye	231,400	14.98	40,771
Sorghum Grain			
Soybeans			
Tobacco			
Wheat	10,491,400	8.61	988,412
Fruit, Vegetables and Specialty Crops			
Apples			
Peaches			
Potatoes	1,015,800	--	--
Sugar Beets	13,995,200	2.02	288,531
Tomatoes:			
Fresh			
Processing			
Total	39,124,800	--	1,836,546

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Appendix table 1--Average annual value of production, hail insurance loss rates and estimated annual hail losses of major crops, by regions and States, 1966-70--Continued

Crops	Average annual value of production	Hail insurance loss rates	Estimated annual hail losses
COLORADO	Dollars	Percent	Dollars
Field Crops			
Barley	11,966,800	7.62	987,086
Corn for Grain	33,213,000	6.88	2,453,881
Cotton:			
Lint			
Seed			
Dry Beans	14,491,400	9.88	1,588,715
Dry Peas			
Flaxseed			
Oats	2,486,200	5.31	139,420
Rye	586,400	10.90	71,737
Sorghum Grain	13,953,600	2.33	332,875
Soybeans			
Tobacco			
Wheat	82,294,200	9.34	8,478,136
Fruit, Vegetables and Specialty Crops			
Apples	3,209,400	13.64	506,904
Peaches	1,502,600	--	--
Potatoes	20,579,800	2.74	579,772
Sugar Beets	32,461,400	2.23	740,400
Tomatoes:			
Fresh	444,600	11.30	56,640
Processing	384,200	11.30	48,945
Total	217,573,600	--	15,984,511
NEW MEXICO			
Field Crops			
Barley	917,800	4.55	43,751
Corn for Grain	1,421,600	1.63	23,556
Cotton:			
Lint	31,278,000	5.08	1,673,960
Seed	3,892,400	5.08	208,316
Dry Beans	205,200	1.72	3,591
Dry Peas			
Flaxseed			
Oats			
Rye			
Sorghum Grain	22,335,000	2.33	532,820
Soybeans			
Tobacco			
Wheat	11,380,000	8.16	1,011,115
Fruit, Vegetables and Specialty Crops			
Apples	1,343,000	16.43	264,036
Peaches			
Potatoes	1,484,800	3.35	51,465
Sugar Beets			
Tomatoes:			
Fresh			
Processing	281,400	4.86	14,375
Total	74,539,200	--	3,826,985

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Appendix table 1--Average annual value of production, hail insurance loss rates and estimated annual hail losses of major crops, by regions and States, 1966-70--Continued

Crops	Average annual value of production	Hail insurance loss rates	Estimated annual hail losses
ARIZONA	Dollars	Percent	Dollars
Field Crops			
Barley	12,445,800	.09	11,211
Corn for Grain	849,000	3.18	27,885
Cotton:			
Lint	97,032,200	2.46	2,447,192
Seed	12,238,800	2.46	308,668
Dry Beans			
Dry Peas			
Flaxseed			
Oats			
Rye			
Sorghum Grain	20,686,000	1.21	253,366
Soybeans			
Tobacco			
Wheat	6,622,400	.76	50,716
Fruit, Vegetables and Specialty Crops			
Apples			
Peaches			
Potatoes	7,402,600	--	--
Sugar Beets	3,070,400	--	--
Tomatoes:			
Fresh			
Processing			
Total	160,347,200	--	3,099,038
UTAH			
Field Crops			
Barley	7,753,000	1.07	83,854
Corn for Grain			
Cotton:			
Lint			
Seed			
Dry Beans	510,400	1.78	9,250
Dry Peas			
Flaxseed			
Oats	916,400	2.55	23,980
Rye			
Sorghum Grain			
Soybeans			
Tobacco			
Wheat	12,918,200	1.09	142,360
Fruit, Vegetables and Specialty Crops			
Apples	1,373,400	20.36	351,110
Peaches	779,000	6.06	50,253
Potatoes	3,158,800	.66	20,987
Sugar Beets	7,092,000	--	--
Tomatoes:			
Fresh			
Processing	1,045,000	5.39	59,534
Total	35,546,200	--	741,328

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Appendix table 1--Average annual value of production, hail insurance loss rates and estimated annual hail losses of major crops, by regions and States, 1966-70--Continued

Crops	Average annual value of production	Hail insurance loss rates	Estimated annual hail losses
NEVADA	Dollars	Percent	Dollars
Field Crops			
Barley	1,193,600	--	--
Corn for Grain			
Cotton:			
Lint			
Seed			
Dry Beans			
Dry Peas			
Flaxseed			
Oats	87,000	--	--
Rye			
Sorghum Grain			
Soybeans			
Tobacco			
Wheat	1,416,000	--	--
Fruit, Vegetables and Specialty Crops			
Apples			
Peaches			
Potatoes			
Sugar Beets			
Tomatoes:			
Fresh			
Processing			
Total	2,696,600	--	--
PACIFIC			
Field Crops			
Barley	109,192,000	--	1,276,588
Corn for Grain	32,183,600	--	12,570
Cotton:			
Lint	222,740,600	--	245,284
Seed	28,611,800	--	31,508
Dry Beans	39,370,600	--	55,914
Dry Peas	8,161,400	--	111,666
Flaxseed	252,600	--	--
Oats	10,424,400	--	90,512
Rye	1,167,400	--	16,637
Sorghum Grain	36,588,800	--	--
Soybeans			
Tobacco			
Wheat	257,055,000	--	1,302,791
Fruit, Vegetables and Specialty Crops			
Apples	99,786,000	--	2,327,433
Peaches	95,292,800	--	363,977
Potatoes	145,300,600	--	713,512
Sugar Beets	107,809,400	--	145,393
Tomatoes:			
Fresh	69,627,200	--	12,186
Processing	135,765,000	--	--
Pears	67,487,400	--	1,927,701
Sweet Cherries	32,794,600	--	1,152,969
Plums	19,146,200	--	1,399,137
Total	1,518,757,400		11,185,778

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Appendix table 1--Average annual value of production, hail insurance loss rates and estimated annual hail losses of major crops, by regions and States, 1966-70--Continued

Crops	Average annual value of production	Hail insurance loss rates	Estimated annual hail losses
WASHINGTON	Dollars	Percent	Dollars
Field Crops			
Barley	16,133,800	.42	68,048
Corn for Grain	3,994,200	.26	10,412
Cotton:			
Lint			
Seed			
Dry Beans	5,219,000	1.06	55,914
Dry Peas	7,488,400	1.31	99,400
Flaxseed			
Oats	3,037,000	.47	14,341
Rye	788,400	.67	5,318
Sorghum Grain			
Soybeans			
Tobacco			
Wheat	180,234,000	.36	651,187
Fruit, Vegetables and Specialty Crops			
Apples	75,218,400	2.26	1,739,243
Peaches	2,783,400	3.14	90,232
Potatoes	41,847,400	--	--
Sugar Beets	19,240,400	.75	145,393
Tomatoes:			
Fresh	552,000	2.16	12,186
Processing			
Pears	16,391,600	1.46	242,863
Sweet Cherries	9,072,000	.37	33,691
Plums			
Total	382,000,000	--	3,168,228
OREGON			
Field Crops			
Barley	16,281,800	1.15	189,419
Corn for Grain	1,196,600	.18	2,158
Cotton:			
Lint			
Seed			
Dry Beans			
Dry Peas	673,000	1.79	12,266
Flaxseed	3,733,800	1.07	40,384
Oats	379,000	2.90	11,319
Rye			
Sorghum Grain			
Soybeans			
Tobacco			
Wheat	53,967,000	.85	462,652
Fruit, Vegetables and Specialty Crops			
Apples	5,183,800	1.00	52,352
Peaches	934,400	4.52	44,234
Potatoes	24,464,200	.05	12,238
Sugar Beets	6,523,600	--	--
Tomatoes:			
Fresh			
Processing			
Pears	15,774,600	3.73	611,190
Sweet Cherries	11,946,400	.27	32,343
Plums			
Total	141,058,200	--	1,470,555

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Appendix table 1--Average annual value of production, hail insurance loss rates and estimated annual hail losses of major crops, by regions and States, 1966-70--Continued

Crops	Average annual value of production	Hail insurance loss rates	Estimated annual hail losses
CALIFORNIA	Dollars	Percent	Dollars
Field Crops			
Barley	76,776,400	1.31	1,019,121
Corn for Grain	26,992,800	--	--
Cotton:			
Lint	222,740,600	.11	245,284
Seed	28,611,800	.11	31,508
Dry Beans	34,151,600	--	--
Dry Peas			
Flaxseed	252,600	--	--
Oats	3,653,600	.97	35,787
Rye			
Sorghum Grain	36,588,800	--	--
Soybeans			
Tobacco			
Wheat	22,854,000	.82	188,952
Fruit, Vegetables and Specialty Crops			
Apples	19,383,800	2.69	535,838
Peaches	91,575,000	.25	229,511
Potatoes	78,989,000	.88	701,274
Sugar Beets	82,045,400	--	--
Tomatoes:			
Fresh	69,075,200	--	--
Processing	135,765,000	--	--
Pears	35,321,200	2.95	1,073,648
Sweet Cherries	11,776,200	8.45	1,086,935
Plums	19,146,200	6.81	1,399,137
Total	995,699,200	--	6,546,995

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